Pine Wilt

Rapid wilting and death of pine

Pathogen—The pine wood nematode, *Bursaphelenchus xylophilus*, causes pine wilt disease. Nematodes are "roundworms" in the phylum Nematoda, which has over 80,000 described species. This disease can be a problem wherever non-native pines are planted but is most common in Kansas, Nebraska, and South Dakota.

Vectors—The pine sawyer beetles, *Monochamus* spp., transmit the nematode. Please see the Roundheaded Wood Borers (Longhorned Beetles) entry in this guide for more information.

Hosts—Scots, Austrian, and other non-native pines are often killed by this disease. Eastern white pine, a native pine, is also affected and may be killed by pine wilt disease. The nematode commonly infects other native pines and some native conifer species. However, most native species are resistant to the disease (e.g., native conifers may be infected and express little or no disease symptoms).

Figure 1. Symptoms of pine wilt disease on Austrian pine branch. *Photo: North Central Research Station Archive, USDA Forest Service, Bugwood.org.*

Signs and Symptoms—As with many wilts, signs are microscopic. The pine wood nematode is relatively large compared with other nematodes, but it cannot be seen with a hand-lens in infected wood. Laboratory tests are required to confirm its presence.

Pine wilt disease causes rapid wilting and death on non-native pines. Symptoms are often first expressed in early summer but can occur throughout the growing season. Symptoms may first appear on one or a few branches but often develop quickly throughout the crown, and trees may die only 1 or 2 months after symptoms appear. Trees seldom survive more than a year. Symptoms start with needle discoloration, which progresses rapidly from a grayish green to yellow and then to brown. Needles can but often do not show wilt-type symptoms, and needles are usually retained for a few months (figs. 1-2).

Figure 2. Crown symptoms of pine wilt disease on Scots pine. *Photo: James T. Blodgett, USDA Forest Service.*

Disease Cycle—The nematode is introduced into pines as the pine sawyer beetles feed (fig. 3) or lay eggs. Eggs are laid in egg niches chewed by the females. When the beetle feeds on a healthy tree or chews the egg niches, the nematodes leave the beetle and enter the tree through the wounds. The nematodes reproduce rapidly in resin canals and go from egg to adult in 5 days with many eggs per nematode. They then spread rapidly within xylem tracheids and clog the water transport system of the pines, thus causing disruption of water movement throughout the tree (i.e., a vascular wilt disease). Nematodes can overwinter in dead or living pine.

Nematodes feed on fungi in the wood, including bluestain fungi (fig. 4) that are transmitted by engraver and other bark beetles. The nematodes can survive and reproduce with fungi in dead, stressed, and living pine. Therefore, this pathogen can be found on trees killed by other causes.

Figure 3. Nematodes can be transmitted to pines when the adult pine sawyer beetle feeds on shoots. *Photo: L. D. Dwinell, USDA Forest Service, Bugwood.org.*

Nematodes can overwinter in a dormant state. As wood dries, they molt and enter a dormant phase high in lipids and do not feed. This phase is resistant to unfavorable environmental conditions.

The pine sawyer beetles lay eggs in dying or recently dead trees in spring. The eggs hatch, the beetle larvae bore into the wood to feed, and the beetle overwinters as larvae or pupae. Before emerging as young adults, the beetles acquire the nematodes. These beetles transmit nematodes to healthy trees.

Impact—The disease quickly kills exotic pines (especially when grown on poor sites with dry, shallow soils) but usually has little effect on native pines.

Management—Sanitation (removal of in-fected materials) can reduce new infections. Infected trees should be cut and the wood should be burned, buried, or chipped. The nematode can survive for a time in cut wood that can attract beetles, which results in subsequent disease spread. Infected wood should not be kept for firewood without removing the bark. Anything that reduces pine sawyer beetle attraction and breeding success will reduce losses. This includes reducing stresses from other diseases, insects, or the environment.

Figure 4. Bluestain fungal mycelium in pine wood is a source of food for the nematode. *Photo: North Central Research Station Archive, USDA Forest Service, Bugwood.org.*

Planting native tree species suitable to the site will reduce losses. Although they may be infected, native conifers seldom develop pine wilt disease symptoms. Even native pines planted off-site rarely develop this wilt disease. If exotic pines are desired, they should only be grown on favorable sites.

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1. Kondo, E.; Foudin, A.; Linit, M.; Smith, M.; Bolla, R.; Winter, R.; Dropkin, V. 1982a. Pine wilt disease–nematological, entomological, and biochemical investigations. Publication SR 282. Columbia, MO: University of Missouri Agricultural Experiment Station. 56 p.
2. Malek, R.B.; Appleby, J.E. 1984. Epidemiology of pine wilt in Illinois. Plant Disease 68:180-186.
3. Wingfield, M.J.; Blanchette, R.A.; Nicholls, T.H. 1984. Is the pine wood nematode an important pathogen in the United States? Journal of Forestry 82:232-235.